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(54) VIRTUAL REALITY GLASSES

(57) The present invention relates to virtual reality glasses, which include: a glasses body (1), which defines a first surface (11) towards a user's face and a second surface (12) configured to have an external electronic device (200) mounted thereon for playing virtual reality content; and a fastening structure configured to fasten the external electronic device (200) to the second surface (12). The fastening structure includes: a connector fastener (31) with a built-in connector (313) which is connectable to an interface at a first end of the external electronic device (200), wherein the connector fastener (31) enables the connector (313) to rotate between a predetermined maximum tilt opening angle (α) and a horizontal fastening angle, and the connector fastener (31) is configured to fasten the first end of the external electronic device (200) at the horizontal fastening angle; and at least one device fastener (32) which is configured to fasten a second end of the external electronic device (200).

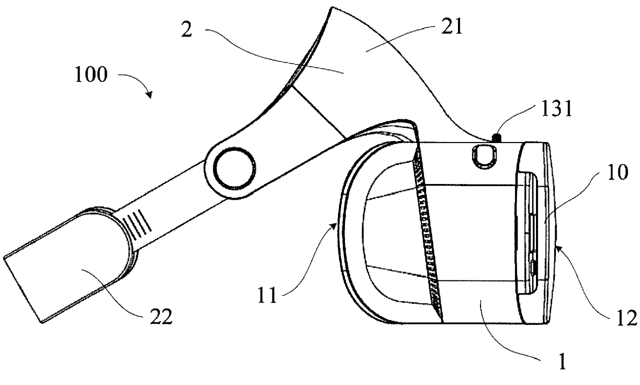

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the field of terminal technology, and more particularly to virtual reality glasses.

BACKGROUND

[0002] The virtual reality (VR) technology is a computer simulation system, which can generate a simulated environment and provide immersive experience for a user by way of three-dimensional dynamic scenes, interactions among entities and so on.

[0003] In related art, one simple and cheap virtual reality solution is provided by providing virtual reality glasses including virtual reality function components and by using an external electronic device such as the user's mobile phone or tablet to play virtual reality content.

[0004] However, since different external electronic devices have big differences in sizes, specifications, materials and so on, if an external electronic device is not effectively restricted at a position, the external electronic device is prone to vibrate, shake, or the like during use, which affects the user's immersive experience during use, and even causes the user to feel discomfort such as vertigo.

SUMMARY

[0005] In order to solve the above problem in the related art, the present invention provides virtual reality glasses.

[0006] According to a first aspect of embodiments of the present invention, virtual reality glasses are provided and include: a glasses body, which defines a first surface towards a user's face and a second surface configured to have an external electronic device mounted thereon for playing virtual reality content; and a fastening structure configured to fasten the external electronic device to the second surface. The fastening structure includes: a connector fastener with a built-in connector, wherein the connector is connectable to an interface at a first end of the external electronic device, the connector fastener enables the connector to rotate between a predetermined maximum tilt opening angle and a horizontal fastening angle, and the connector fastener is configured to fasten the first end of the external electronic device at the horizontal fastening angle; and at least one device fastener which is configured to fasten a second end of the external electronic device.

[0007] Optionally, the connector fastener is suitable for external electronic devices of different sizes by switching among gear positions along a horizontal direction.

[0008] Optionally, the connector fastener includes: a connector fixing seat configured to fasten the first end of the external electronic device, wherein the connector is secured within the connector fixing seat; a movable plate hinged to the connector fixing seat to enable the connector fixing seat to rotate between the maximum tilt opening angle and the horizontal fastening angle, wherein the movable plate is configured to slide along a first slide rail on the second surface, so as to drive the connector fixing seat to horizontally move back and forth between a plurality of gear positions, and a plurality of notches corresponding to the plurality of gear positions are defined in a lateral side of the movable plate; a gear-position stopper configured to engage with one of the notches so as to restrict the connector fixing seat to the gear position corresponding to the one of the notches; and a gear-position adjusting button, wherein when an external force is applied to the gear-position adjusting button, the gear-position adjusting button is configured to trigger the gear-position stopper to move away from the one of the notches so that the connector fixing seat is switched from a current gear position to another gear position through a horizontal movement.

[0009] Optionally, a first notch and a second notch corresponding respectively to a first gear position and a second gear position of the connector fastener are horizontally defined in the lateral side of the movable plate; and a horizontal movement distance of the movable plate matches a spacing distance between the first notch and the second notch. The connector fastener further includes a first elastic element, wherein when the gear-position stopper engages with the first notch, the first elastic element is deformed to make the movable plate tend to move horizontally. When the external force is applied to the gear-position adjusting button to trigger the gear-position stopper to move away from the first notch, the movable plate is driven by the first elastic element to move horizontally so that the second notch horizontally moves along with the movable plate until the second notch engages with the gear-position stopper.

[0010] Optionally, each notch includes: a first horizontal lateral wall which is configured to engage with the gear-position stopper to limit the gear position so as to restrict movement of the movable plate towards a first horizontal direction; and a second horizontal lateral wall of a slope shape, wherein when the movable plate is moved towards a second horizontal direction, the gear-position stopper slides outside of the corresponding notch along the second horizontal lateral wall; and the second horizontal direction is opposite to the first horizontal direction.

[0011] Optionally, the device fastener is configured to horizontally move back and forth between a maximum opening position and a minimum fastening position which are predetermined at the second surface; when the device fastener is moved to a certain fastening position, the second end of the external electronic device is fastened by the device fastener; and when the device fastener is moved to a certain opening position, fastening of the external electronic device is released.

[0012] Optionally, the device fastener includes: a device fixing seat, which is configured to fasten the second end of the external electronic device and which is configured to slide along a second slide rail on the second surface; and a second elastic element, wherein when the device fixing seat is at a position other than the minimum fastening position, the second elastic element is deformed to make the device fixing seat have a movement tendency to return to the minimum fastening position.

[0013] Optionally, the fastening structure further includes: at least one lateral side fastener to fasten the external electronic device at a lateral side position of the external electronic device.

[0014] Optionally, the virtual reality glasses further include: a device bouncing-up structure, which includes a support member in a preset hole in the second surface, and a third elastic element arranged at a bottom of the support member. When the external electronic device is fastened to the second surface, the external electronic device presses the support member to cause the third elastic element to be deformed as well as cause at least part of the support member to be retracted into the preset hole. When fastening of the external electronic device is released by the device fastener, the third elastic element drives the support member to extend outside of the preset hole to lift up the external electronic device.

[0015] Optionally, the virtual reality glasses further include: a wearing structure configured to secure the glasses body to the user's face. The wearing structure includes: a fixed connection portion, wherein a bottom of the fixed connection portion is fixed to a top portion of the glasses body; and a wearing adjustment portion, wherein the fixed connection portion and the wearing adjustment portion each have a curved shape, and they constitute a ring structure that fits the user's head; and the wearing adjustment portion is configured to adjust a size of the ring structure.

[0016] Optionally, the wearing adjustment portion includes: an adjustment portion body, wherein an adjusting gear is provided in the adjustment portion body; an adjustment band extending out from the adjustment portion body, wherein one end of the adjustment band is connected with the fixed connection portion, and a gear belt is provided at one portion of the adjustment band near the other end of the adjustment band and cooperates with the adjusting gear. When the adjusting gear is rotated towards a first direction, the adjusting gear cooperates with the gear belt to extend the adjustment band further outside of adjustment portion body, thereby enlarging the ring structure. When the adjusting gear is rotated towards a second direction, the adjusting gear cooperates with the gear belt to retract the adjustment band further into the adjustment portion body, thereby decreasing the ring structure.

[0017] Optionally, an adjustment knob is provided in the adjustment portion body and is configured to rotate synchronously with the adjusting gear; a self-locking protrusion is provided at a surface of the adjustment knob, and the self-locking protrusion is able to engage with a self-locking recess in an inner wall of the adjustment portion body. When the self-locking protrusion engages with the self-locking recess, the adjusting gear and the adjustment knob are switched to a rotation self-locking state, in which adjustment of the size of the ring structure is limited. When the self-locking protrusion escapes from the self-locking recess, the adjusting gear and the adjustment knob are switched to a free rotation state, in which the size of the ring structure is adjustable via rotation of the adjusting gear and the adjustment knob.

[0018] Optionally, at least part of the adjustment knob extends outside through a preset opening in the adjustment portion body. When the adjustment knob is moved under action of an external force to one side of the preset opening along a first axis direction of the adjustment knob, the adjustment knob is switched to the rotation self-locking state. When the adjustment knob is moved under action of an external force to another side of the preset opening along a second axis direction of the adjustment knob, the adjustment knob is switched to the free rotation state and is driven by an external force to rotate so as to adjust the size of the ring structure.

[0019] Optionally, the adjustment portion body further includes therein: an adjustment button, wherein an installation position of the adjustment button on the adjustment portion body corresponds to the adjustment knob, and when the adjustment button is pressed by an external force, the adjustment button pushes the adjustment knob to move, thereby switching the adjustment knob to the free rotation state; and a fourth elastic element, wherein the fourth elastic element is deformed when the adjustment knob is switched to the rotation self-locking state, and when the external force stops pressing the adjustment button, the fourth elastic element drives the adjustment knob to return back to the rotation self-locking state.

[0020] Optionally, the wearing adjustment portion is rotatably connected with the fixed connection portion.

[0021] Optionally, the virtual reality glasses further include: an object distance adjusting structure configured to adjust a distance between a lens assembly in the glasses body and the external electronic device. The object distance adjusting structure includes: an object distance adjusting knob, wherein at least part of the object distance adjusting knob extends outside through a preset opening in the glasses body; an adjusting nut and an adjusting threaded rod, wherein the adjusting nut is secured on the lens assembly and the adjusting threaded rod is in engagement with the adjusting nut, and the adjusting nut and the adjusting threaded rod are oriented towards the external electronic device; and a helical gear set, wherein the helical gear set is rotated along with the object distance adjusting knob when the object distance adjusting knob is driven by an external force to rotate, and drives the adjusting threaded rod to rotate, so as to adjust a distance between the lens assembly and the external electronic device through a relative rotation between the adjusting nut and the adjusting threaded rod.

[0022] The technical solutions provided by the embodiments of the present invention may have the following advantageous effects.

[0023] As can be seen from the above embodiments, in the embodiments of the present invention, by providing the connector fastener being able to rotate to a tilt opening angle, the external electronic device is enabled to connect with the connector in the connector fastener at the tilt opening angle, which not only facilitates the user to perform connection operation, but also reduces probability of damage to the connector. Meanwhile, the connector fastener and the device fastener simultaneously fasten the first end and the second end of the external electronic device, respectively, which helps to tightly fasten the external electronic device, thereby preventing content displayed by the external electronic device from shifting, shaking, etc., relative to the user's sight so as to prevent the user's immersive experience from being affected, as well as to prevent the user from feeling discomfort such as vertigo caused by screen shaking.

[0024] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the present invention and, together with the description, serve to explain the principles of the present invention.

Fig. 1 is a side view of virtual reality glasses according to an exemplary embodiment.

Fig. 2 is a schematic diagram of wearing virtual reality glasses according to an exemplary embodiment.

Fig. 3 is an assembly diagram of virtual reality glasses and an external electronic device according to an exemplary embodiment.

Figs. 4-5 are schematic diagrams illustrating using a fastening structure to fasten an external electronic device according to an exemplary embodiment.

Fig. 6 is an exploded view of a fastening structure of virtual reality glasses according to an exemplary embodiment.

Fig. 7 is a schematic diagram illustrating engagement between notches and a protrusion of a connector fastener according to an exemplary embodiment.

Fig. 8 is an exploded view of a wearing adjustment portion of a wearing structure of virtual reality glasses according to an exemplary embodiment.

Fig. 9 is a schematic diagram illustrating wearing and adjusting virtual reality glasses according to an exemplary embodiment.

Fig. 10 is another schematic diagram illustrating wearing and adjusting virtual reality glasses according to an exemplary embodiment.

Fig. 11 is a schematic diagram illustrating adjusting engagement between a fixed connection portion and a wearing adjustment portion of virtual reality glasses according to an exemplary embodiment.

Fig. 12 is a schematic diagram illustrating wearing virtual reality glasses according to an exemplary embodiment.

Fig. 13 is an exploded view of an object distance adjusting structure of virtual reality glasses according to an exemplary embodiment.

Fig. 14 is a schematic diagram illustrating adjusting an object distance of virtual reality glasses according to an exemplary embodiment.

DETAILED DESCRIPTION

[0026] Reference will now be made in detail to certain exemplary embodiments, examples of which are illustrated in the accompanying drawings. The following description refers to the accompanying drawings in which the same numbers in different figures represent the same or similar elements unless otherwise indicated. The implementations set forth in the following description of embodiments do not represent all implementations consistent with the invention. Instead, they are merely examples of apparatuses and methods consistent with aspects related to the invention as recited in the appended claims.

[0027] Fig. 1 is a side view of virtual reality glasses according to an exemplary embodiment of the present invention. As shown in Fig. 1, the virtual reality glasses 100 may include a glasses body 1, and the glasses body 1 defines (or comprises) a first surface 11 and a second surface 12. The first surface 11 is towards a user's face. For example, in Fig. 2 which is a schematic diagram showing that a user wears the virtual reality glasses 100, the first surface 11 is towards and fits on the user's face, thereby facilitating the user to watch virtual reality content. Meanwhile, when an end cap 10 of the glasses body 1 on the second surface 12 is removed, it can be seen in combination with Fig. 3 that an external electronic device 12 can be mounted on the second surface 12. The external electronic device 12 is configured to play the virtual reality content that the user can watch from the first surface 11.

[0028] In order to match the virtual reality content, a headset position groove 121 as shown in Fig. 3 may further be defined in the second surface 12, so that a headset 300 may cooperate with a headset jack in an external electronic device 200 through the headset position groove 121 and then the headset 300 may output audio content that matches the virtual reality content.

[0029] In the technical solution of the present invention, the virtual reality glasses 100 includes a fastening structure, which can tightly fasten the external electronic device 200 to the second surface 12, thereby preventing content displayed by the external electronic device 200 from shifting, shaking, etc., relative to the user's sight so as to prevent the user's immersive experience from being affected, as well as to prevent the user from feeling discomfort such as vertigo caused by screen shaking. For example, as shown in Fig. 3, the fastening structure may include a connector fastener 31 and at least one device fastener 32. The connector fastener 31 is configured to fasten a first end of the external electronic device 200, and the device fastener 32 is configured to fasten a second end of the external electronic device 200, thereby fastening the external electronic device 200 at a plurality of positions simultaneously to ensure mounting stability of the external electronic device 200.

[0030] The connector fastener 31 includes a built-in connector (e.g. an electrical connector such as a USB connector, etc.), and the connector is connectable to an interface at the first end of the external electronic device 200. For example, when the interface of the external electronic device 200 is a USB interface, the connector is a corresponding USB connector. Of course, this is not limited in the present invention. Thus, the first end of the external electronic device 200 is one end where the interface is provided, and the second end is another end opposite to the first end. For example, the first end is a bottom end of the external electronic device 200, and the second end is a top end of the external electronic device 200. Thus, the connector fastener 31 serves to fasten the external electronic device 200 while docking with the interface of the external electronic device 200. The device fastener 32 does not have a built-in connector, and is merely used to fasten the external electronic device 200.

[0031] The connector fastener 31 and the device fastener 32 fasten the external electronic device 200 in the following manner.

[0032] As shown in Fig. 4, at least part of the connector fastener 31 is rotatable. Since the connector 313 is provided in the connector fastener 31, the connector 313 can rotate along with the connector fastener 31 in a rotation angle range which may be between a predetermined maximum tilt opening angle α and a horizontal fastening angle (for any angle in the present invention, the direction of the plane where the second surface 12 is located is taken as a horizontal direction). Further, the connector 313 may be plugged into the interface of the external electronic device 200 at any tilt opening angle.

[0033] As shown in Fig. 5, after the connector 313 is plugged into the interface of the external electronic device 200, the connector fastener 31 and the external electronic device 200, as a whole, are rotated to the horizontal fastening angle, to enable the connector fastener 31 to fasten the first end (i.e., a left end in Figs. 4-5) of the external electronic device 200 through a protrusion 31A. Meanwhile, the device fastener 32 is always kept at the horizontal fastening angle, and may fasten the second end (i.e., a right end in Figs. 4-5) of the external electronic device 200 through a protrusion 32A shown in Fig. 5.

[0034] It should be noted that:

1. An accommodating chamber is defined between the protrusion 31A and the protrusion 32A. An opening of the accommodating chamber is smaller than the external electronic device 200, so that the protrusion 31A and the protrusion 32A restrict and fasten the external electronic device 200. Then, in order to enable the external electronic device 200 to smoothly enter the accommodating chamber, the device fastener 32 is capable of horizontally moving back and forth between a maximum opening position and a minimum fastening position which are predetermined at the second surface 12. For example, the maximum opening position is at a point B and the minimum fastening position is at a point A. Then, the device fastener 32 is capable of moving back and forth between the point A and the point B.
   By moving back and forth between the point A and the point B, the device fastener 32 is suitable for external electronic devices of different sizes, with the device fastener 32 located at different fastening positions as well as different opening positions. For example, as shown in Fig. 5, when the external electronic device 200 is fastened by the device fastener 32, the device fastener 32 is at a point C, that is, the fastening position corresponding to the external electronic device 200 is at the point C; and when the external electronic device 200 is at any point between a point D and the point B, the external electronic device 200 can be removed from the device fastener 32, that is, the opening position corresponding to the external electronic device 200 is at any point between the point D and the point B.
   Then, when the device fastener 32 is moved to the fastening position corresponding to the external electronic device 200, the second end of the external electronic device 200 is fastened by the device fastener 32. When the device fastener 32 is moved to the opening position corresponding to the external electronic device 200, fastening of the external electronic device 200 is released.
2. A rotatable structure design for the connector fastener 31 plays an important role in the process of mounting the external electronic device 200, and can ensure that the external electronic device 200 is first plugged into the connector 313 at a predetermined tilt opening angle and then the external electronic device 200 is rotated from the predetermined tilt opening angle to the horizontal fastening angle.

[0035] Since the interface of the external electronic device 200 is small in size, when the connector fastener 31 and the device fastener 32 are used to fasten two ends of the external electronic device 200 respectively, the user tends to first plug the connector 313 into the interface, rather than first using the device fastener 32 to fasten the second end of the external electronic device 200 and then plugging the connector 313 into the interface. In fact, if the second end of the external electronic device 200 is first fastened by the device fastener 32, movable space and other aspects of the external electronic device 200 will be limited, and it is difficult to complete plugging of the connector 313 into the interface.

[0036] As shown in Fig. 5, when the external electronic device 200 is finally mounted on the second surface 12, both of the interface of the external electronic device 200 and the connector 313 are at the horizontal fastening angle. Thus, when an angle of the connector 313 is not adjustable, the connector 313 is always kept at the horizontal fastening angle. However, when the user directly plugs the connector 313 into the interface of the external electronic device 200, due to obstruction of the device fastener 32, plugging of the connector 313 into the external electronic device 200 has to be performed in a state (i.e., a state shown in Fig. 4) where a preset angle is kept between the external electronic device 200 and the second surface 12. In other words, a certain angle must exists between the external electronic device 200 and the connector 313, which makes it difficult to plug the connector 313 into the external electronic device 200 and which may cause the connector 313 to be broken or the like during the process of plugging.

[0037] Thus, in the present invention, the structure of the connector fastener 31 is improved to enable the connector 313 to rotate to a preset title opening angle, so that when the connector 313 is rotated to be parallel to the external electronic device 200 (i.e., which is situation shown in Fig. 4), it can be ensured that the connector 313 is parallel to the interface of the external electronic device 200 when docking therewith. This not only facilitates plugging, but also effectively prevents the connector 313 from being broken or the like.

[0038] Hereinafter, structures of the connector fastener 31 and the device fastener 32 will be described respectively, with reference to Fig. 6 which is an exploded view of the fastening structure.

1) The connector fastener 31

[0039] As an exemplary embodiment, the connector fastener 31 may include a movable plate 311 and a connector fixing seat 312. The connector fixing seat 312 is hinged to the movable plate 311 to enable the connector fixing seat 312 to rotate between the maximum tilt opening angle and the horizontal fastening angle.

[0040] The connector fixing seat 312 may fasten the first end of the external electronic device 200, and the connector 313 is secured within the connector fixing seat 312. For example, the connector fixing seat 312 may include a main portion 312A and a separate portion 312B. An accommodating cavity may be defined between the main portion 312A and the separate portion 312B, and accommodate the connector 313. An opening may be defined in the separate portion 312B, so that a port of the connector 313 may extend outside through the opening to be plugged into the interface of the external electronic device 200. After the main portion 312A and the separate portion 312B are secured together through screws and so on, the connector 313 may also be pressed and secured by the main portion 312A and the separate portion 312B, thereby ensuring that the connector 313 is rotated synchronously with the connector fixing seat 312.

[0041] Further, by switching among gear (or adjustment) positions along the horizontal direction, the connector fastener 31 may be suitable for external electronic devices of different sizes. For example, as shown in Fig. 5, in addition to rotating to the predetermined tilt opening angle, the connector fastener 31 can further be moved along the horizontal direction to a preset gear position, which is similar to the horizontal movement of the device fastener 32, thereby adjusting a spacing distance between the connector fastener 31 and the device fastener 32 and then achieving compatibility to external electronic devices 200 of different sizes.

[0042] For example, as shown in Fig. 6, the movable plate 311 may slide along a first slide rail 122 on the second surface 12, so as to drive the connector fixing seat 312 to horizontally move back and forth between a plurality of gear positions. A plurality of notches 314 may be defined in a lateral side of the movable plate 311 and correspond to the plurality of gear positions. The connector fastener 31 may further include a gear-position stopper 315 configured to engage with each of the notches 314 so as to restrict the connector fixing seat 312 to a respective one of the gear positions. For example, the connector fastener 31 may further include a gear-position adjusting button 316. The gear-position adjusting button 316 may extend through a cover 10 at an outside of the second surface 12, so that the user can apply an external force to the gear-position adjusting button 316 to trigger the gear-position stopper 315 to move away from the notch where the gear-position stopper 315 is located and thus stop restricting the movable plate 311 and the connector fixing seat 312. As a result, the connector fixing seat 312 may be switched from the current gear position to another gear position through a horizontal movement (that is, the gear-position stopper 315 is moved away from the notch corresponding to the current gear position, and enters the notch corresponding to the other gear position).

[0043] For example, in the embodiment shown in Fig. 6, a first notch 314A and a second notch 314B are horizontally defined in a lateral wall of the movable plate 311, and correspond to a first gear position and a second gear position of the connector fastener 31 respectively. The connector fastener 31 may further include a first elastic element 317. When the gear-position stopper 315 engages with the first notch 314A, the first elastic element 317 is deformed to make the movable plate 311 tend to move horizontally. When an external force is applied to the gear-position adjusting button 316 to trigger the gear-position stopper 315 to move away from the first notch 314A, the movable plate 311 may be driven by the first elastic element 317 to move horizontally. Then, when a horizontal movement distance of the movable plate 311 matches a spacing distance between the first notch 314A and the second notch 314B, the second notch 314B horizontally moves along with the movable plate 311 to a position where it is just to be able to engage with the gear-position stopper 315.

[0044] For example, as shown in Fig. 6, it is assumed that the first notch 314A is located at a left side of the second notch 314B and the first elastic element 317 is at a right side of the movable plate 311. When the movable plate 311 moves to the rightmost position, the first notch 314A just engages with the gear-position stopper 315. At this point, the first elastic element 317 is compressed by the movable plate 311, so that the first elastic element 317 produces a reaction force towards the left side. When the gear-position adjusting button 316 is pressed by the user, the gear-position stopper 315 moves away from the first notch 314A, so that the movable plate 311 moves towards the left to the leftmost position under action of the first elastic element 317. As a result, the second notch 314B just aligns with the gear-position stopper 315, so that the gear-position stopper 315 may enter the second notch 314B to engage with the second notch 314B.

[0045] Further, each notch in the movable plate 311 may include a first horizontal lateral wall and a second horizontal lateral wall. The first horizontal lateral wall may engage with the gear-position stopper 315 to limit the gear position, so as to restrict movement of the movable plate 311 towards a first horizontal direction. The second horizontal lateral wall is of a slope shape. When the movable plate 311 is moved towards a second horizontal direction, the gear-position stopper 315 may slide outside of the corresponding notch along the second horizontal lateral wall. The second horizontal direction is opposite to the first horizontal direction. Since the movable plate 311 is moved along the horizontal direction and the notches are in the lateral wall of the movable plate 311, the plurality of notches are arranged along the horizontal direction and each notch has two lateral walls in the horizontal direction.

[0046] For example, as shown in Fig. 7, the first notch 314A includes a first horizontal lateral wall A1 and a second horizontal lateral wall A2. The second notch 314B includes a first horizontal lateral wall B1 and a second horizontal lateral wall B2. The first horizontal direction may be a direction a, and the second horizontal direction may a direction b. As can be seen from Fig. 7, the first horizontal lateral wall A1 and the second horizontal lateral wall A2 both can engage with the gear-position stopper 315, so as to restrict movement of the movable plate 311 towards the direction a. However, since the second horizontal lateral wall A2 and the second horizontal lateral wall B2 each are of a slope shape, when the gear-position stopper 315 is in the second notch 314B, by pushing the entire movable plate 311 towards the direction b, the gear-position stopper 315 can slide outside of the second notch 314B along the second horizontal lateral wall B2 and further slides into the first notch 314A.

[0047] Then, referring in combination to the embodiment shown in Fig. 6, when the gear-position stopper 315 is located in the first notch 314A to make the connector fastener 31 at the first gear position, the user may press the gear-position adjusting button 316 to cause the gear-position stopper 315 to move away from the first notch 314A. Then, the movable plate 311 can be driven by the first elastic element 317 to move towards left so that the gear-position stopper 315 enters the second notch 314B and limits the connector fastener 31 at the second gear position. Further, when the user pushes the movable plate 311 or the connector fixing seat 312 to cause the movable plate 311 to move towards the right, the second horizontal lateral wall B2 of slope shape as shown in Fig. 7 enables the gear-position stopper 315 to move away from the second notch 314B and return to the first notch 314A to limit the connector fastener 31 at the first gear position. Thus, through the above "pressing the gear-position adjusting button 316" and "pushing the connector fixing seat 312", adjustment of gear positions of the connector fastener 31 can be achieved, and the operations are simple and effective.

2) the device fastener 32

[0048] As an exemplary embodiment, as shown in Fig. 6, the device fastener 32 may include: a device fixing seat 321, which can fasten the second end of the external electronic device 200 and which can slide along a second slide rail 123 on the second surface 12; and a second elastic element 322. When the device fixing seat 321 is at a position other than the minimum fastening position (for example, the point A shown in Fig. 5), the second elastic element 322 is deformed to make the device fixing seat 321 have a movement tendency to return to the minimum fastening position. Thus, different from the connector fastener 31 whose gear position is adjustable, the device fixing seat 321 has no gear position when the device fixing seat 321 is moved along the horizontal direction. Rather, the device fixing seat 321 can move freely between the minimum fastening position and the maximum opening position, thereby being suitable for external electronic devices of different sizes.

[0049] Actually, the size of the external electronic device 200 is usually larger than a distance between the connector fastener 31 and the minimum fastening position of the device fastener 32, so that after the external electronic device 200 has been mounted, the second elastic element 322 is always in a deformed state, thereby enabling the device fastener 32 to clamp the external electronic device 200 along the horizontal direction, so as to ensure mounting stability of the external electronic device 200.

[0050] In the virtual reality glasses 100 of the present invention, in addition to the connector fastener 31 and the device fastener 32, as shown in Fig. 6, the fastening structure may further include at least one lateral side fastener 33 to fasten the external electronic device 200 at a lateral side position of the external electronic device 200. As a result, the lateral side fastener 33, the connector fastener 31 and the device fastener 32 together tightly fasten the external electronic device 200.

[0051] In addition, in order to facilitate removal of the external electronic device 200, the virtual reality glasses 100 of the present invention may further include at least one device bouncing-up structure. As shown in Fig. 6, the device bouncing-up structure may include a support member 323 in a preset hole 124 in the second surface 12, and a third elastic element 324 arranged at a bottom of the support member 323.

[0052] When the external electronic device 200 has not been mounted, at least part of the support member 323 can extend outside of the preset hole 124, and the third elastic element 324 almost has no deformation. When the external electronic device 200 has been fastened to the second surface 12, the external electronic device 200 can press the support member 323, and thus cause the third elastic element 324 at the bottom of the support member 323 to be deformed as well as cause at least part of the support member 323 to be retracted into the preset hole 124. When fastening of the external electronic device 200 is released by the device fastener 32, a reaction force generated by the third elastic element 324 due to deformation may drive the support member 323 to extend outside of the preset hole 124 to lift up the external electronic device 200, thereby enabling a certain angle to be formed between the external electronic device 200 and the second surface 12 and thus facilitating the user to dissemble and remove the external electronic device 200.

[0053] Further, as shown in Fig. 1, in addition to the glasses body 1 and the fastening structure and so on, the virtual reality glasses 100 of the present invention may further include a wearing structure 2 for securing the glasses body 1 to the user's face. The wearing structure 2 may include: a fixed connection portion 21 and a wearing adjustment portion 22. A bottom of the fixed connection portion 21 is fixed to a top portion of the glasses body 1. The fixed connection portion 21 and the wearing adjustment portion 22 each have an arc shape, and they constitute a ring structure that fits the user's head so that the user may wear the virtual reality glasses in a manner such as shown in Fig. 2. The wearing adjustment portion 22 is configured to adjust a size of the ring structure, thereby enabling the wearing structure 2 to be suitable for sizes of different users' heads.

[0054] In this embodiment, both of the fixed connection portion 21 and the wearing adjustment portion 22 may be made of hard material, and can maintain their own states in normal conditions. Compared with soft headbands in related art, the user does not need to manually adjust the state of the wearing structure 2 made of hard material every time the user wears it, and this facilitates the user to quickly wear the virtual reality glasses 100. Of course, soft materials such as sponge and silica gel may be provided at inner sides of the fixed connection portion 21 and the wearing adjustment portion 22, so that the user may feel comfortable.

[0055] In one embodiment, as shown in Fig. 8, the wearing adjustment portion 22 may include an adjustment portion body 221 in which an adjusting gear 224 is provided. The adjustment portion body 221 may include a front shell 221A, a rear shell 221B and a substrate 221C and so on. An accommodating space is defined by the front shell 221A and the rear shell 221B, and accommodates the substrate 221C and the adjusting gear 224 therein. The wearing adjustment portion 22 may further include an adjustment band 222 extending out from the adjustment portion body 221. For example, as shown in Fig. 8, the adjustment band 222 includes a first adjustment band 222A and a second adjustment band 222B. Taking the first adjustment band 222A as an example, one end of the first adjustment band 222A is connected with the fixed connection portion 21; and a gear belt 223 is provided at one portion of the first adjustment band 222A near the other end of the first adjustment band 222A, and cooperates with the adjusting gear 224.

[0056] When the adjusting gear 224 is rotated towards a first direction, the adjusting gear 224 cooperates with the gear belt 223 of each adjustment band 222 to extend the corresponding adjustment band 222 to extend further outwardly, thereby enlarging the ring structure defined by the fixed connection portion 21 and the wearing adjustment portion 22. When the adjusting gear 224 is rotated towards a second direction, the adjusting gear 224 cooperates with the gear belt 223 to retract the corresponding adjustment band 222 further into the adjustment portion body 221, thereby decreasing the ring structure.

[0057] In other words, when the adjustment portion body 221 and the fixed connection portion 21 are connected through the adjustment band 222, the rotation cooperation between the adjustment band 222 and the adjusting gear 224 can control a length by which the adjustment band 222 extends outwardly from the adjustment portion body 221 or by which the adjustment band 222 retracts into the adjustment portion body 221, i.e., controlling a distance between the adjustment portion body 221 and the fixed connection portion 21, thereby adjusting the size of the ring structure defined by the fixed connection portion 21 and the wearing adjustment portion 22.

[0058] Further, an adjustment knob 225 may be provided in the adjustment portion body 221 and is capable of rotating synchronously with the adjusting gear 224. A self-locking protrusion is provided at a surface of the adjustment knob 225. The self-locking protrusion may engage with a self-locking recess 228 in an inner wall of the adjustment portion body 221 (for example, in an inner wall of the rear shell 221B). Thus, when the self-locking protrusion at the surface of the adjustment knob 225 engages with the self-locking recess 228, the adjusting gear 224 and the adjustment knob 225 are switched to a rotation self-locking state, in which adjustment of the size of the ring structure is prevented. When the self-locking protrusion escapes from the self-locking recess 228, the adjusting gear 224 and the adjustment knob 225 are switched to a free rotation state, in which the size of the ring structure can be adjusted via rotation of the adjusting gear 224 and the adjustment knob 225.

[0059] The engagement state between the self-locking protrusion and the self-locking recess 228 may be adjusted in a plurality of manners, thereby switching the adjusting gear 224 and the adjustment knob 225 to the rotation self-locking state or the free rotation state. This is illustrated with the following examples.

[0060] In one case, as shown in Fig. 8, the adjustment portion body 221 may include therein an adjustment button 226 and a fourth elastic element 227. An installation position of the adjustment button 226 on the adjustment portion body 221 corresponds to the adjustment knob 225. When the adjustment button 226 is pressed by an external force, the adjustment button 226 can push the adjustment knob 225 to move, thereby switching the adjustment knob 225 to the free rotation state (that is, when the adjustment knob 225 is not pushed to move, the adjustment knob 225 is in the rotation self-locking state).

[0061] The fourth elastic element 227 is deformed when the adjustment knob 225 is switched to the rotation self-locking state (for example, the fourth elastic element 227 is pressed by the adjustment button 226 to be deformed). When the external force stops pressing the adjustment button 226, the fourth elastic element 227 drives the adjustment knob 225 to return back to the rotation self-locking state.

[0062] Thus, as shown in Fig. 9, when the user intends to adjust the wearing structure 2, the user may press the adjustment button 226 at a rear side of the adjustment portion body 221 via a finger. Then, by manually pulling outwardly or pushing inwardly the entire adjustment portion body 221, cooperation between the adjusting gear 224 and the adjustment band 222 can be actuated to enlarge or decrease the size of the ring structure.

[0063] In another case, as shown in Fig. 10, at least part of the adjustment knob 225 may extend outside through a preset opening 229 in the adjustment portion body 221. Thus, when the adjustment knob 225 is moved under action of an external force to one side of the preset opening (for example, one side which is away from the user) along a first axis direction (e.g., a direction x) of the adjustment knob 225, the adjustment knob 225 is switched to the rotation self-locking state.

[0064] When the adjustment knob 225 is moved under action of an external force to another side of the preset opening (for example, one side which is close to the user) along a second axis direction (e.g., a direction y) of the adjustment knob 225, the adjustment knob 225 is switched to the free rotation state. Then, the user can directly apply an external force to the adjustment knob 225 to cause the adjustment knob 225 to rotate (around a rotation axis) so as to adjust the size of the ring structure.

[0065] In addition, in one embodiment, as shown in Fig. 11, the wearing adjustment portion 22 is rotatably connected with the fixed connection portion 21. Thus, the user may first rotate the wearing adjustment portion 22 to a position D1 shown in Fig. 11; then, after the wearing adjustment portion 22 is worn on the user's head, the wearing adjustment portion 22 is rotated downward from the position D1 to a position D2 as shown in Fig. 12, thereby enabling the virtual reality glasses to be easily worn without having to repeatedly adjust wearing posture and so on.

[0066] Moreover, if the user, when wearing and using the virtual reality glasses 100, wants to leave the virtual reality world for a moment but does not want to take off the virtual reality glasses 100, the glasses body 1 and the fixed connection portion 21 may be lifted up as a whole (actually, frames of the two portions may be integrally formed) relative to the wearing adjustment portion 22, and then the user can temporarily leave the virtual reality world to deal with external things for a moment. After dealing with external things, it is merely needed to turn down the glasses body 100 and the fixed connection portion 21 as a whole, so that the user can quickly return to the virtual reality world. There is no need to take off the virtual reality glasses 100 and wear the virtual reality glasses 100 again in the whole process, which facilitates the user's quick operation.

[0067] In any one of the above embodiments, the wear virtual reality glasses 100 may further include an object distance adjusting structure shown in Fig. 13, which is configured to adjust a distance between a lens assembly 13 in the glasses body 1 and the external electronic device 200. The object distance adjusting structure may include: an object distance adjusting knob 131, an adjusting nut 132, an adjusting threaded rod 133 and a helical gear set 134.

[0068] At least part of the object distance adjusting knob 131 extends outside through a preset opening in the glasses body 1. For example, as shown in Fig. 14, the object distance adjusting knob 131 extends outside from a top side of the glasses body 1.

[0069] The adjusting nut 132 is secured on the lens assembly 13 and the adjusting threaded rod 133 is in engagement with the adjusting nut 132. The adjusting nut 132 and the adjusting threaded rod 133 are oriented towards the external electronic device 200.

[0070] The helical gear set 134 is rotated along with the object distance adjusting knob 131 when the object distance adjusting knob 131 is driven by an external force to rotate. Thus, based on a relative rotation between the adjusting nut 132 and the adjusting threaded rod 133, a distance between the adjusting nut 132 and the adjusting threaded rod 133 is changed accordingly. Meanwhile, positions of the object distance adjusting knob 131, the helical gear set 134 and the adjusting threaded rod 133 are not changed, and a position of the external electronic device 200 is also not changed. Therefore, positions of the adjusting nut 132 and the lens assembly 13, on which the adjusting nut 132 is secured, are changed relative to the external electronic device 200, thereby achieving adjustment of a distance between the lens assembly 13 and the external electronic device 200.

[0071] Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed here. This application is intended to cover any variations, uses, or adaptations of the invention following the general principles thereof and including such departures from the present invention as come within known or customary practice in the art.

Claims

1. Virtual reality glasses comprising:

    a glasses body (1), which defines a first surface (11) towards a user's face and a second surface (12) configured to have an external electronic device (200) mounted thereon for playing virtual reality content; and
    a fastening structure configured to fasten the external electronic device (200) to the second surface (12) and including:

        a connector fastener (31) with a built-in connector (313), wherein the connector (313) is connectable to an interface at a first end of the external electronic device (200), the connector fastener (31) enables the connector (313) to rotate between a predetermined maximum tilt opening angle (α) and a horizontal fastening angle, and the connector fastener (31) is configured to fasten the first end of the external electronic device (200) at the horizontal fastening angle; and
        at least one device fastener (32) which is configured to fasten a second end of the external electronic device (200).

2. The virtual reality glasses according to claim 1, wherein the connector fastener (31) is suitable for external electronic devices (200) of different sizes by switching among gear positions along a horizontal direction.

3. The virtual reality glasses according to claim 2, wherein the connector fastener (31) comprises:

    a connector fixing seat (312) configured to fasten the first end of the external electronic device (200), wherein the connector (313) is secured within the connector fixing seat (312);
    a movable plate (311) hinged to the connector fixing seat (312) to enable the connector fixing seat (312) to rotate between the maximum tilt opening angle and the horizontal fastening angle, wherein the movable plate (311) is configured to slide along a first slide rail (122) on the second surface (12), so as to drive the connector fixing seat (312) to horizontally move back and forth between a plurality of gear positions, and a plurality of notches (314) corresponding to the plurality of gear positions are defined in a lateral side of the movable plate (311);
    a gear-position stopper (315) configured to engage with one of the notches (314) so as to restrict the connector fixing seat (312) to the gear position corresponding to the one of the notches (314); and
    a gear-position adjusting button (316), wherein when an external force is applied to the gear-position adjusting button (316), the gear-position adjusting button (316) is configured to trigger the gear-position stopper (315) to move away from the one of the notches (314) so that the connector fixing seat (312) is switched from a current gear position to another gear position through a horizontal movement.

4. The virtual reality glasses according to claim 3, wherein a first notch (314A) and a second notch (314B) corresponding respectively to a first gear position and a second gear position of the connector fastener (31) are horizontally defined in the lateral side of the movable plate (311), and a horizontal movement distance of the movable plate (311) matches a spacing distance between the first notch (314A) and the second notch (314B);
wherein the connector fastener (31) further comprises: a first elastic element (317), wherein when the gear-position stopper (315) engages with the first notch (314A), the first elastic element (317) is deformed to make the movable plate (311) tend to move horizontally; and
wherein when the external force is applied to the gear-position adjusting button to trigger the gear-position stopper (315) to move away from the first notch (314A), the movable plate (311) is driven by the first elastic element (317) to move horizontally so that the second notch (314B) horizontally moves along with the movable plate (311) until the second notch (314B) engages with the gear-position stopper (315).

5. The virtual reality glasses according to claim 3, wherein each notch comprises:

a first horizontal lateral wall which is configured to engage with the gear-position stopper (315) to limit the gear position so as to restrict movement of the movable plate (311) towards a first horizontal direction; and
a second horizontal lateral wall of a slope shape, wherein when the movable plate (311) is moved towards a second horizontal direction, the gear-position stopper (315) slides outside of the corresponding notch along the second horizontal lateral wall; and the second horizontal direction is opposite to the first horizontal direction.

6. The virtual reality glasses according to claim 1, wherein the device fastener (32) is configured to horizontally move back and forth between a maximum opening position and a minimum fastening position which are predetermined at the second surface (12); when the device fastener (32) is moved to a certain fastening position, the second end of the external electronic device (200) is fastened by the device fastener (32); and when the device fastener (32) is moved to a certain opening position, fastening of the external electronic device (200) is released.

7. The virtual reality glasses according to claim 6, wherein the device fastener (32) comprises:

a device fixing seat (321), which is configured to fasten the second end of the external electronic device (200) and which is configured to slide along a second slide rail (123) on the second surface (12); and
a second elastic element (322), wherein when the device fixing seat (321) is at a position other than the minimum fastening position, the second elastic element (322) is deformed to make the device fixing seat (321) have a movement tendency to return to the minimum fastening position.

8. The virtual reality glasses according to claim 1, wherein the fastening structure further comprises: at least one lateral side fastener (33) to fasten the external electronic device (200) at a lateral side position of the external electronic device (200).

9. The virtual reality glasses according to claim 1, further comprising:

a device bouncing-up structure, which comprises a support member (323) in a preset hole (124) in the second surface (12), and a third elastic element arranged at a bottom of the support member (323),
wherein when the external electronic device (200) is fastened to the second surface (12), the external electronic device (200) presses the support member (323) to cause the third elastic element (324) to be deformed as well as cause at least part of the support member (323) to be retracted into the preset hole (124); and when fastening of the external electronic device (200) is released by the device fastener (32), the third elastic element (324) drives the support member (323) to extend outside of the preset hole (124) to lift up the external electronic device (200).

10. The virtual reality glasses according to claim 1, further comprising: a wearing structure (2) configured to secure the glasses body to the user's face, wherein the wearing structure (2) comprises:

a fixed connection portion (21), wherein a bottom of the fixed connection portion (21) is fixed to a top portion of the glasses body; and
a wearing adjustment portion (22), wherein the fixed connection portion (21) and the wearing adjustment portion (22) each have an arc shape, and they constitute a ring structure that fits the user's head; and the wearing adjustment portion (22) is configured to adjust a size of the ring structure.

11. The virtual reality glasses according to claim 10, wherein the wearing adjustment portion (22) comprises:

an adjustment portion body (221), wherein an adjusting gear (224) is provided in the adjustment portion body (221);
an adjustment band (222) extending out from the adjustment portion body (221), wherein one end of the adjustment band (222) is connected with the fixed connection portion (21), and a gear belt (223) is provided at one portion of the adjustment band (222) near the other end of the adjustment band (222) and cooperates with the adjusting gear (224),
wherein when the adjusting gear (224) is rotated towards a first direction, the adjusting gear (224) cooperates with the gear belt (223) to extend the adjustment band (222) further outside of adjustment portion body (221), thereby enlarging the ring structure; and when the adjusting gear (224) is rotated towards a second direction, the adjusting gear (224) cooperates with the gear belt (223) to retract the adjustment band (222) further into the adjustment portion body (221), thereby decreasing the ring structure.

12. The virtual reality glasses according to claim 11, wherein an adjustment knob (225) is provided in the

adjustment portion body (221) and is configured to rotate synchronously with the adjusting gear (224); a self-locking protrusion is provided at a surface of the adjustment knob (225), and the self-locking protrusion is able to engage with a self-locking recess (228) in an inner wall of the adjustment portion body (221);
when the self-locking protrusion engages with the self-locking recess (228), the adjusting gear (224) and the adjustment knob (225) are switched to a rotation self-locking state, in which adjustment of the size of the ring structure is limited; and when the self-locking protrusion escapes from the self-locking recess (228), the adjusting gear (224) and the adjustment knob (225) are switched to a free rotation state, in which the size of the ring structure is adjustable via rotation of the adjusting gear (224) and the adjustment knob (225).

13. The virtual reality glasses according to claim 12, wherein at least part of the adjustment knob (225) extends outside through a preset opening (229) in the adjustment portion body (221);
when the adjustment knob (225) is moved under action of an external force to one side of the preset opening (229) along a first axis direction of the adjustment knob (225), the adjustment knob (225) is switched to the rotation self-locking state;
when the adjustment knob (225) is moved under action of an external force to another side of the preset opening (229) along a second axis direction of the adjustment knob (225), the adjustment knob (225) is switched to the free rotation state and is driven by an external force to rotate so as to adjust the size of the ring structure.

14. The virtual reality glasses according to claim 12, wherein the adjustment portion body (221) further comprises:

an adjustment button (226), wherein an installation position of the adjustment button (226) on the adjustment portion body (221) corresponds to the adjustment knob (225), and when the adjustment button (226) is pressed by an external force, the adjustment button (226) pushes the adjustment knob (225) to move, thereby switching the adjustment knob (225) to the free rotation state; and
a fourth elastic element (227), wherein the fourth elastic element (227) is deformed when the adjustment knob (225) is switched to the rotation self-locking state, and when the external force stops pressing the adjustment button (226), the fourth elastic element drives the adjustment knob (225) to return back to the rotation self-locking state.

15. The virtual reality glasses according to claim 1, further comprising: an object distance adjusting structure configured to adjust a distance between a lens assembly (13) in the glasses body (1) and the external electronic device (200),
wherein the object distance adjusting structure comprises:

an object distance adjusting knob (131), wherein at least part of the object distance adjusting knob (131) extends outside through a preset opening in the glasses body (1);
an adjusting nut (132) and an adjusting threaded rod (133), wherein the adjusting nut (132) is secured on the lens assembly (13) and the adjusting threaded rod (133) is in engagement with the adjusting nut (132), and the adjusting nut (132) and the adjusting threaded rod (133) are oriented towards the external electronic device (200); and
a helical gear set (134), wherein the helical gear set (134) is rotated along with the object distance adjusting knob (131) when the object distance adjusting knob (131) is driven by an external force to rotate, and drives the adjusting threaded rod (133) to rotate, so as to adjust a distance between the lens assembly (13) and the external electronic device (200) through a relative rotation between the adjusting nut (132) and the adjusting threaded rod (133).

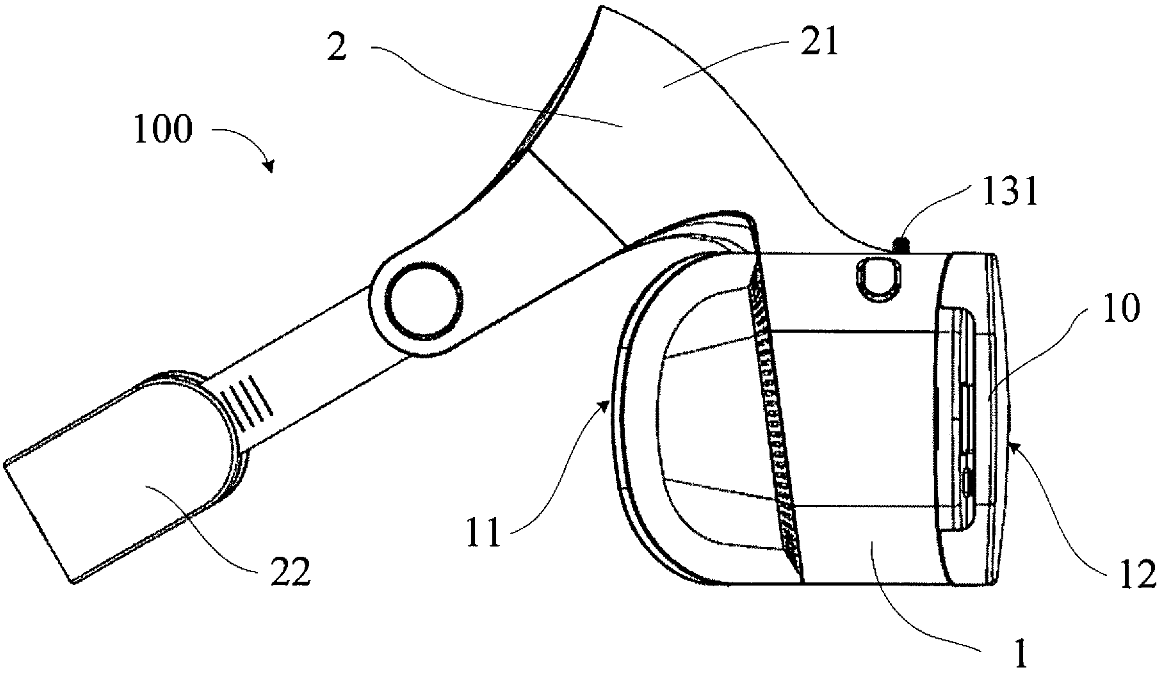


Fig. 1

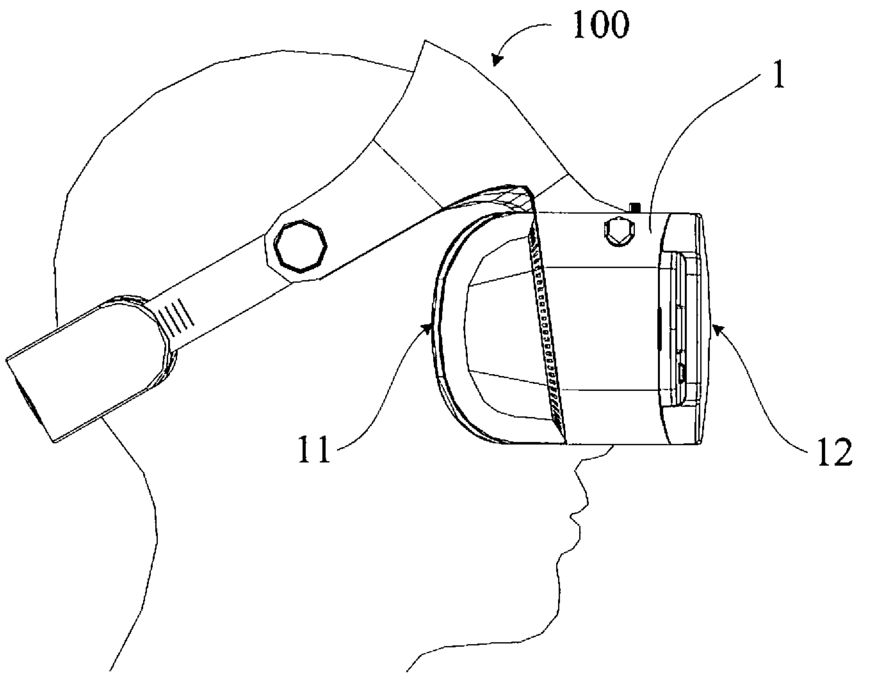


Fig. 2

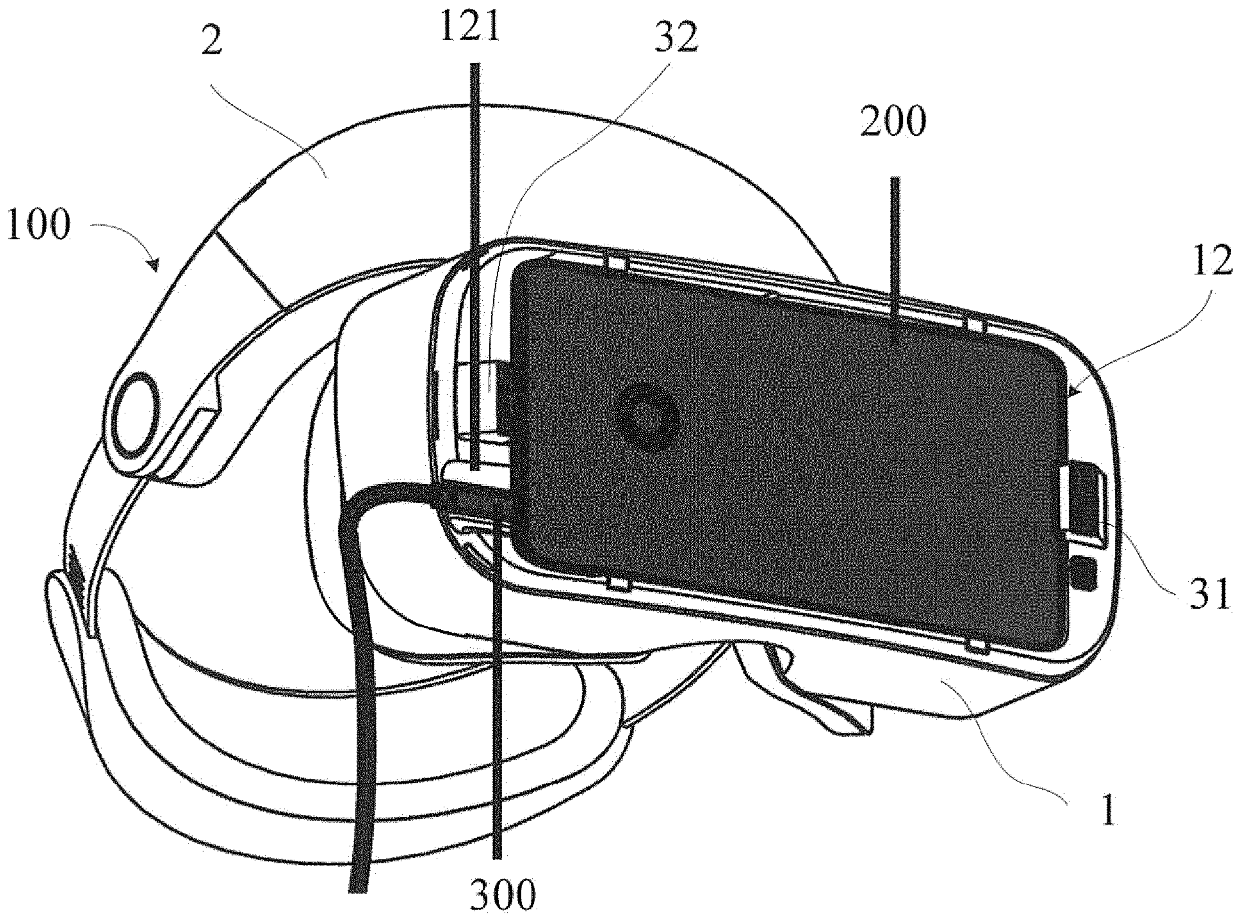


Fig. 3

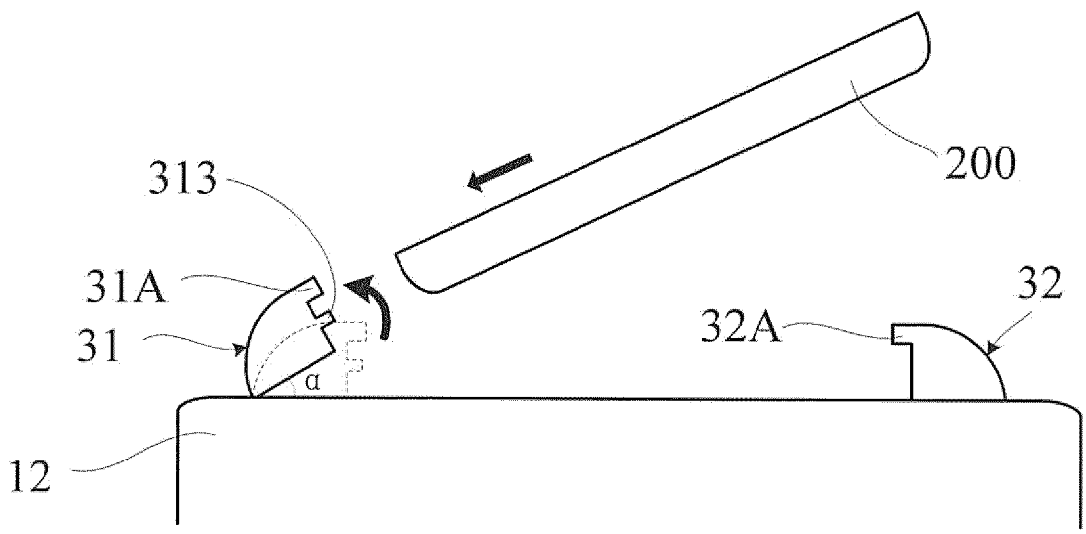


Fig. 4

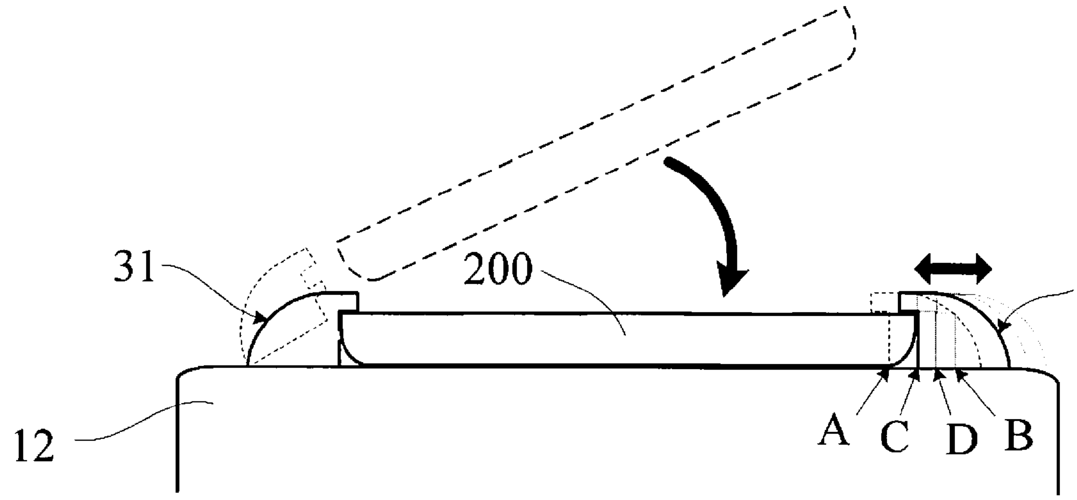
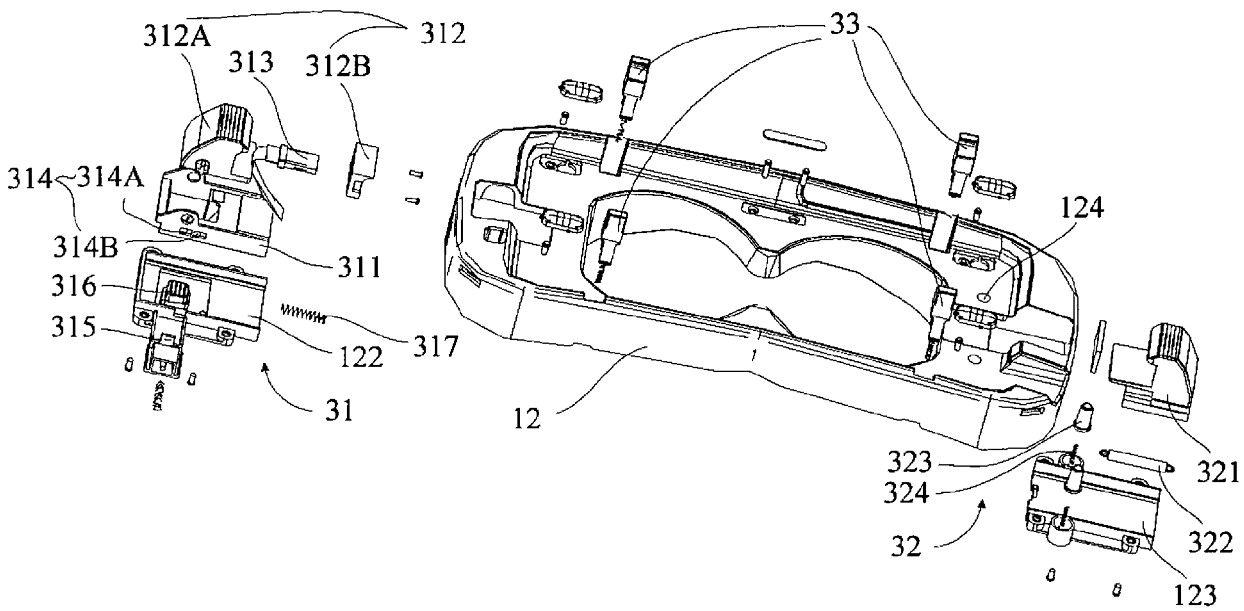

31
200
32
12
A
C
D
B

Fig. 5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313
312B
312
314
314A
314B
311
316
315
122
317
31
33
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12
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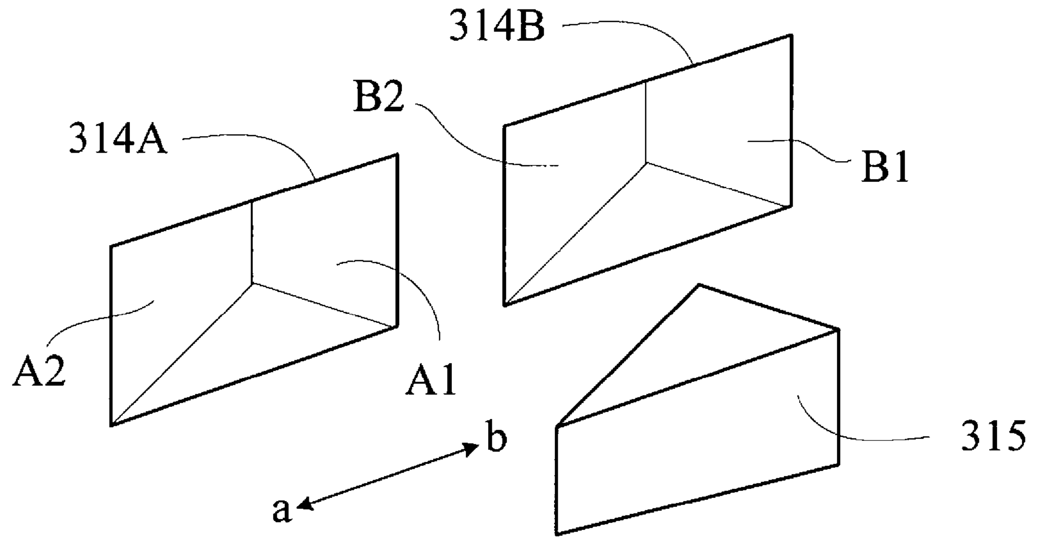
323
324
322
32
123

Fig. 6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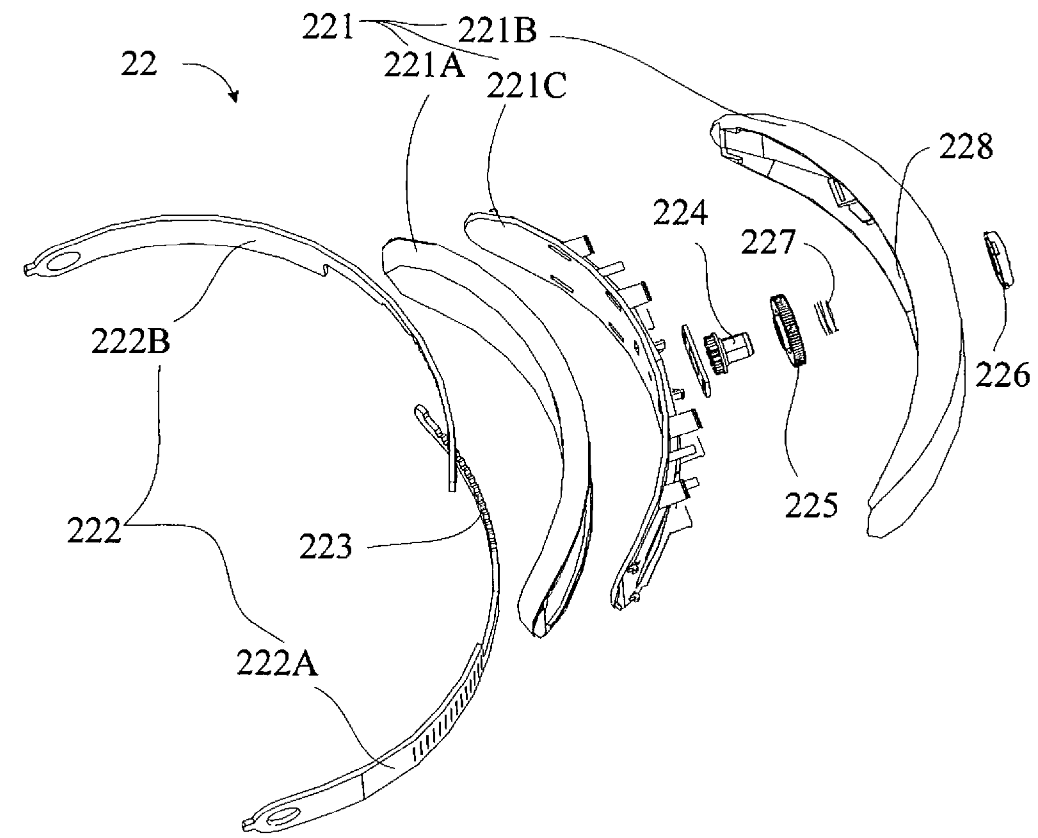
314A
B1
A2
A1
b
315
a

Fig. 7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221B
22
221A
221C
228
224
227
222B
226
225
222
223
222A

Fig. 8

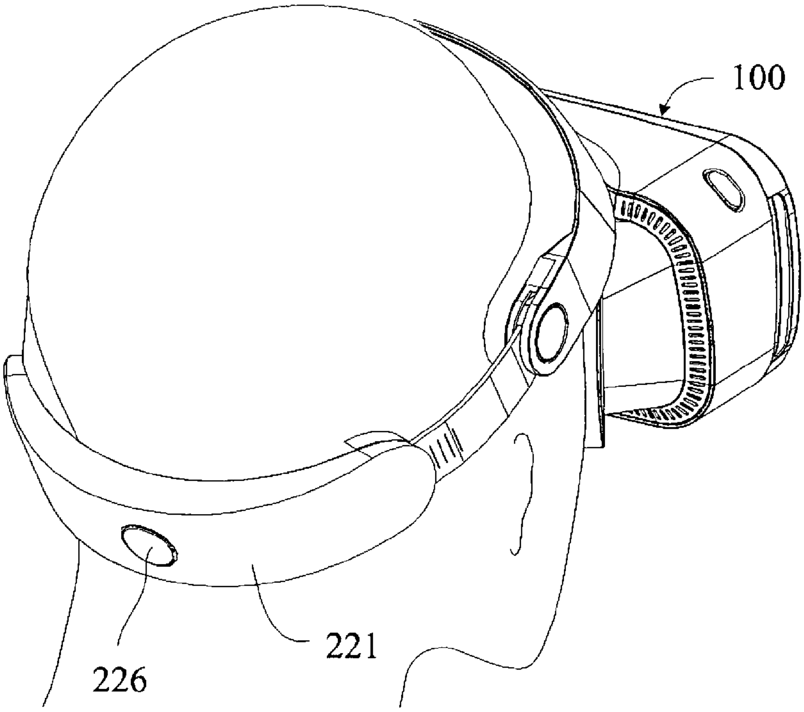

Fig. 9

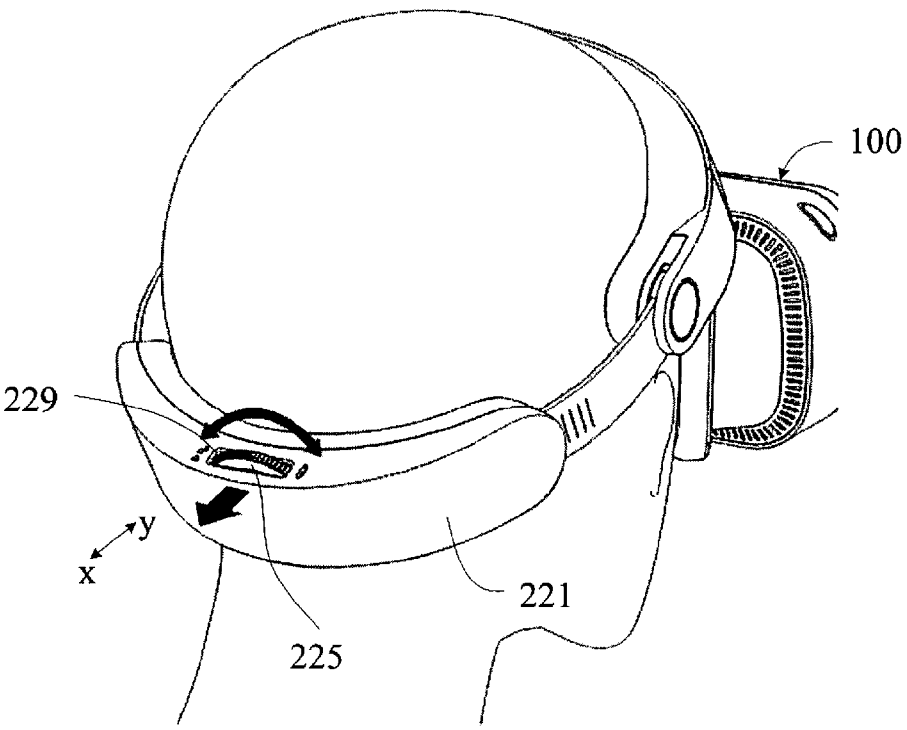

Fig. 10

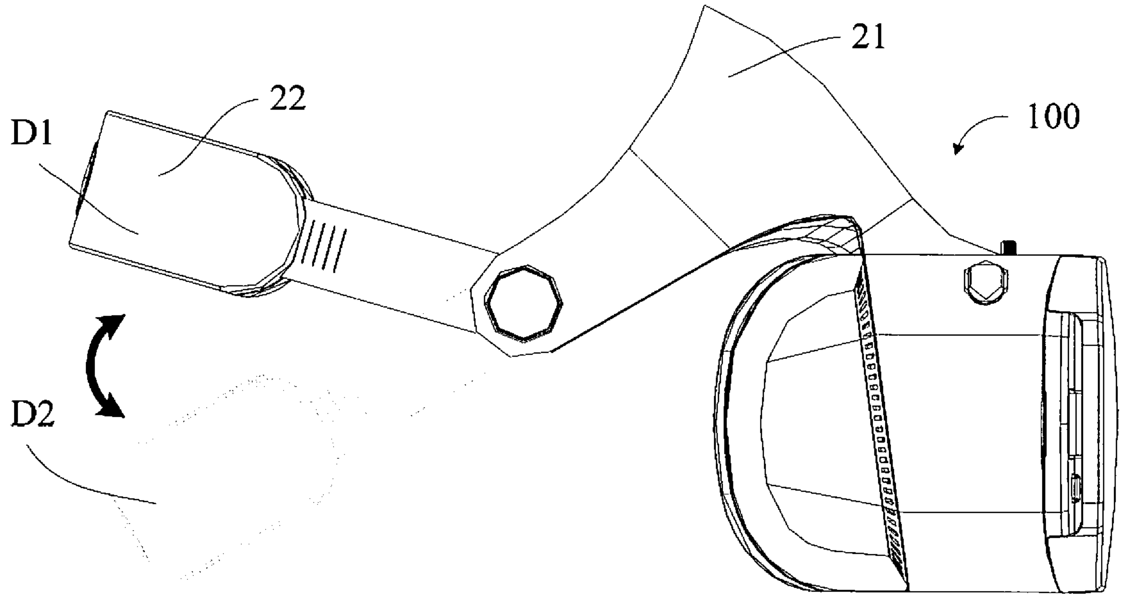

Fig. 11

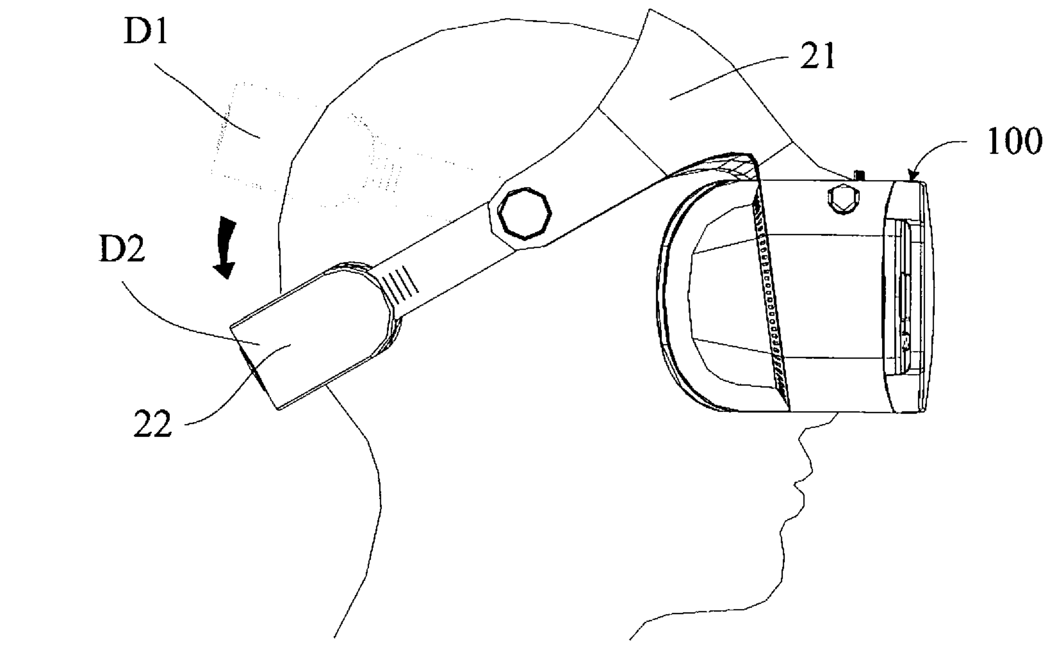

Fig. 12

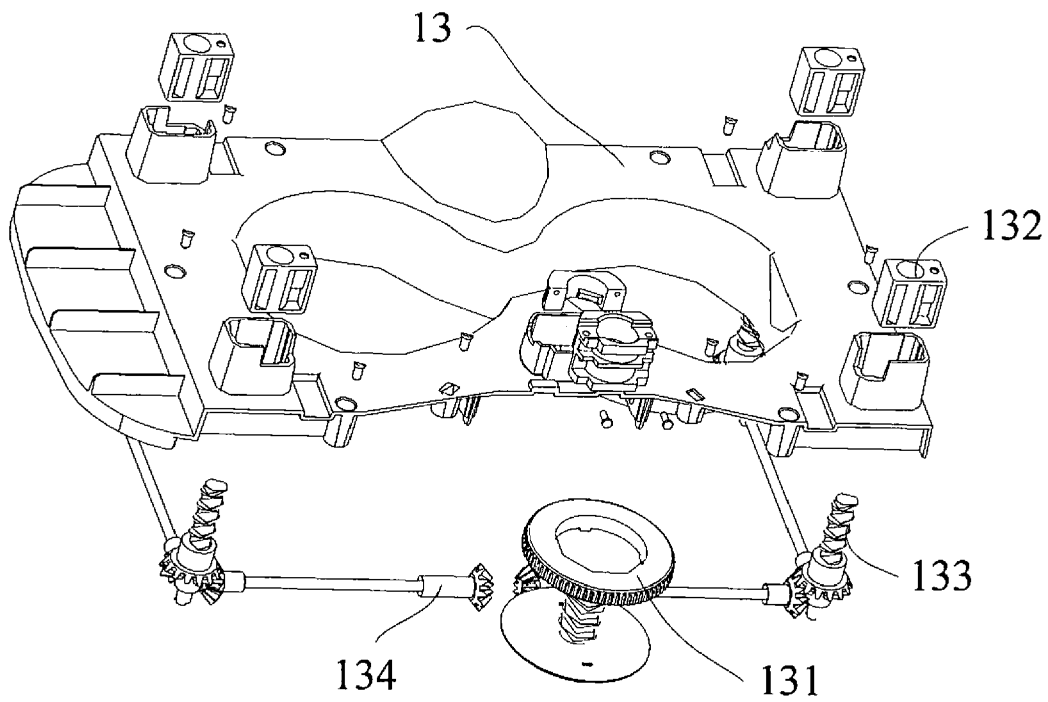

Fig. 13

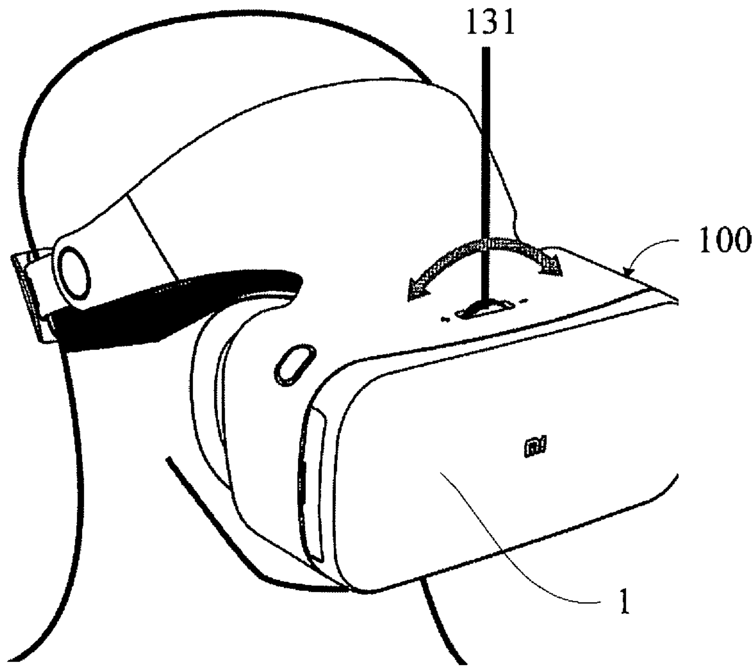

Fig. 14